Department of Fish and Wildlife

DESIGN GUIDELINES APPROVED FOR USE IN DESIGNING WATER CROSSINGS OVER FISH-BEARING WATERS IN WASHINGTON STATE

Low-Volume Roads Engineering, Best Management Practices Field Guide [1]

Notes for appropriate use to comply with WAC 220-660-190

June 11, 2015

Low-Volume Roads was written for a national audience and does not address specific state requirements. In Washington State, fish passage is required for all water crossings in fish-bearing waters (RCW 55.77.030). WAC 22-660-190(2) further requires that "All water crossings must retain up-stream and downstream connection in order to maintain expected channel processes." We recommend reading the entirety of WAC 220-660-190 to fully understand WDFW's expectations for water crossings. Using the notes below as a guide, the designer can use **Low-Volume Roads** to design a crossing acceptable under Washington law.

Only chapters 8, 9, and 10 are reviewed.

Chapter 8 Culvert Use, Installation, and Sizing

Of the 3 chapters on water crossings, Chapter 8 is least applicable to fish-bearing streams in Washington State. While fish passage is mentioned as a design consideration, it is not specifically addressed with criteria or standards. We recommend using the **Water Crossing Design Guidelines** (WCDG)[2] for fish-bearing streams.

Page 75: The design flood capacity is not an important design parameter in itself since culverts tend to fail because of wood or sediment occlusion. With this in mind, WAC 22-660-190 requires that all culverts, even those on non-fish streams, pass wood and sediment so as to prevent catastrophic failure.

Page 76: Trash racks are not recommended on fish-bearing streams since they often cause a passage barrier when not scrupulously maintained.

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[1] Keller, G. and J. Sherar (2003). **Low-volume Roads Engineering, Best Management Practices Field Guide**, US Agency for International Development, USDA Forest Service, Virginia Polytechnic Institute and State University.

[2] Barnard RJ, Johnson J, Brooks P, Bates KM, Heiner B, Klavas JP, Ponder DC, Smith PD, Powers PD. 2013. **Water Crossings Design Guidelines.** Washington Department of Fish and Wildlife: Olympia, Washington.

Page 77: For the last 20 years in Washington, culvert span has generally been determined by using the bankfull width as a parameter, usually with some factor of safety. BFW is readily measured, accounts for the passage of most debris, and reflects rainfall and watershed characteristics.

Figure 8.2 c: All culverts in fish-bearing waters are countersunk, invert depressed below the streambed, and filled with stream-like material.

Figure 8.6: trash racks are not recommended for fish-bearing streams.

Chapter 9 Fords and Low-Water Crossings

Chapter 9 provides valuable guidance for developing practical and environmentally responsible low-water crossing structures. WDFW approves using these guidelines to arrive at a plan for a ford crossing fish-bearing waters that complies with WAC 220-660-190(10) and RCW 77.57.030. However, the designer should be aware that all water crossings must maintain expected channel processes, including the movement of wood and sediment and shifting channel patterns. A ford crossing non-fish-bearing waters must be designed to pass wood and sediment expected in the stream reach, in order to reduce the risk of catastrophic failure.

Fish passage is addressed in the first paragraph of page 93, describing either vented fords with box culverts and a natural stream bottom or simple on-grade fords as the ideal structures. These structures would likely meet the requirements of WAC 220-660-190, although the designer should be careful to maintain adequate width and depth, and eliminate over-steepened sections and vertical drops. Vented fords in fish bearing waters should be approached as one would a culvert, using the no-slope or stream simulation design methods (see **WCDG**), or equivalent. Avoid vented fords with a width or slope significantly smaller or steeper than the natural adjacent channel. Should designers need to size a culvert that is narrower than the BFW, they would use the provisions in WAC 220-160-200.

Chapter 10 Bridges

The designer is encouraged to read WAC 220-660-190(4) and (5) as well as Chapter 4 in the **WCDG** to fully understand design considerations for the protection of fishlife.

WDFW encourages the team approach to bridge design.

Page 100, Recommended Practices: when determining the bridge span, consider channel confinement (the width of the floodplain relative to the BFW). Where the floodplain is wide and carries a large proportion of the total flow, the bridge span cannot be determined simply as a function of the BFW, as is suggested on this page. Scour and lateral motion are likely to plague the bridge for its entire life span and it will require repeated countermeasures. The remaining Recommended Practices are, from our point of view, good advice.